INVAGINATION OF MECKEL'S DIVERTICULUM ASSOCIATED WITH INTUSSUSCEPTION: REPORT OF A CASE, WITH A STUDY OF RECORDED CASES.

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Meckel's diverticulum has long been known as a cause of abdominal disorders. A common source of disturbance is obstruction caused by the constriction of coils of intestine about the diverticulum when both its ends are attached. When the distal end is free the diverticulum itself not uncommonly becomes in some manner twisted upon itself or strangulated.

A less common source of trouble is inversion of the diverticulum into the lumen of the bowel, thereby causing obstruction to the intestine. In a number of instances inverted diverticula are associated with intussusception of the intestine. The diverticulum may pass into an intussusception without itself becoming inverted. Which of these events is cause and which effect is a matter of controversy that will later receive attention. It is the purpose of this paper to collect all the cases of inversion combined with intussusception recorded in the literature. We are able to add one of our own. On the basis of the data thus collected the question of pathogenesis will be discussed, the problem of the pathology stated, the results of treatment as heretofore carried out summarized, and the problem of the best method of treatment presented for the critical consideration of the reader. Our case is as follows:

F. M. W., aged nineteen years. Two years ago the patient had a severe attack of abdominal cramps. He attributed it to eating raisins. The attending physician at his first visit found nothing, but an examination made a day later revealed a tumor immediately below the umbilicus. This was supposed by his physician to be a mass of raisins and he manipulated it with his fingers in order to break up the lump. The cramps subsided and flatus and stool passed on the next day. The patient was free from any complaint from that time until December 18, 1912, when he became chilly and nauseated while loading a wagon. The two days following he felt much improved. On the third day he ate a hearty breakfast and later a ham sandwich, and took a small drink of whisky, to which he was not accustomed. He immediately began to have cramp and walked about to lessen the pain. After a few hours he vomited freely. The pains increased during the afternoon, and he rolled about from pain, and a doctor was summoned. Morphin was administered hypodermically and was repeated the following day.

Many enemas were employed during the following days, but pain and vomiting continued. During this period the physician was able to palpate a tumor to the right of the median line. On Friday the enema brought away a piece of the meat eaten on the Sunday previous; this gave some relief, and a little supper was eaten. On the following day he became worse again and was brought to the Halstead Hospital Saturday afternoon, with the diagnosis of intestinal obstruction. On examination the abdomen was but little sensitive, and there was no rigidity. Two hypodermics of morphin had been given during the day, which made this negative evidence of little value. There was moderate distention; no dulness in either flank; the tongue was dry and coated; there was no evidence of impending collapse. Pulse, 144; temperature, 97°; respiration, 24.

The abdomen was opened in the median line below the umbilicus. When the peritoneum was opened about a quart of straw-colored fluid escaped. The intestinal coils appearing in the incision were injected and much distended. There was no paralysis. The ileocecal portion of the intestine was at once sought and was found lying over the kidney. It presented a tumor. When the tumor was drawn into the wound it was seen to be an intussusception through the ileocecal valve, about twelve inches long, with a distinct tumor at its upper extremity. The tumor was thought to be a polyp which had produced the inversion of the gut. When the intussusception was reduced by traction and pressure on the tumor a dimple remained over the base of the supposed polyp. This made it obvious that the tumor mass was an inverted Meckel's diverticulum, with a thickened apex. By careful pressure the diverticulum was restored to its former position. The diverticulum was nearly the diamater of the gut from which it sprang, and was about two and a half inches long. The mass in its apex was about the size of a hulled walnut. The diverticulum was clamped just below the solid mass and a mattress suture passed on the ileal side of the clamp. The clamp was removed and the gut severed, the edge being cauterized with carbolic acid and iodin. This raw end was then inverted into the lumen of the gut. The contracture of the walls of the intestine after the suture line had been inverted resulted in narrowing the lumen of the gut more than had been intended. No evil resulted, however, as the lumen remaining was the size of a finger, but looked small in contrast to the adjoining dilated gut. The cecum was replaced and the loop of ileum containing the stump of the diverticulum was pulled over above and distal to the cecum. An inch stab opening was made in the side just above the crest of the ilium. A small, flat gauze pack was placed over the ileum and a drainage-tube below it. The incision in the median line was closed completely.

Following the operation the patient awoke quickly, and at 6 P.M.

his chart showed pulse, 132; temperature, 100.8°; respiration, 28. At 9 P.M.: pulse, 124; temperature, 101°; respiration, 28. He attempted to vomit and his stomach was emptied by lavage of a large amount of greenish fluid. Flatus was expelled late in the evening following an enema. There were emesis and repeated gastric lavages in the days following. On Tuesday, the third day, there was free bowel movement, with much flatus, and the patient complained of hunger. On the fifth day, Friday, the chart showed pulse, 92; temperature, 99.2°; respiration, 24. Saturday: pulse, 78; temperature, 99.4°; respiration, 24; on the seventh day: pulse, 68; temperature, 98.4°; respiration, 20. During the first two days there was a profuse drainage of cloudy serum from the drainage opening; this became reduced at the end of the second day, and the drains were removed. The skin of the entire central incision opened on the sixth day, and a considerable amount of pus was expelled.

Pathologic examination of the specimen: The part removed consisted of a mass about the size of a hulled walnut, with a flange of diverticular wall below it in which the muscular and mucous coats could be readily made out. On section the mass was seen to be composed in part of blood clot, giving the appearance of a submucous accumulation of blood of some days' duration. At the apex of the tumor immediately beneath the peritoneum was a cap 3 or 4 mm. thick, which was pearly white and resembled when cut the section of a skin papilloma. Microscopic examination showed the submucous thickening was due to an old blood clot. Toward the opening of the diverticulum the mucosa was normal, but at the apex it was continuous with the white thickened cap. The latter proved to be composed of glandular tissue arranged in two distinct layers; an inner, made up of Brunner's glands somewhat irregularly disposed; and an outer, which resembled the benign adenomas so often found in the intestines. This arrangement suggested strongly the aberrant masses of pancreatic tissue, which have often been reported present in Meckel's diverticula, and particularly the case in which Küttner observed both Brunner's glands and aberrant pancreatic tissue. The fact that in our case some of the misshapen Brunner's glands terminated in the adenomatous portion, raises the question whether the so-called pancreatic tissue may not in reality have been aberrant intestinal glands. The cases in the literature are, however, given with too little detail to permit one to do more than speculate in this direction.

The cases which we have been able to find reported in the literature as invagination of a Meckel's diverticulum with intussusception are some of them so incomplete as to be mere statements that such cases were observed. The reports of others show that they do not belong to the group of cases under consideration. A third group is reported fully enough to permit a judgment of the anatomic characters of the lesion and to give a picture of the clinical course. The last group only will receive detailed consideration, though a list of the incompletely reported cases will be appended.

Case 1.—1894. Studsgaard, *Centralbl. f. Chirurgie*, 1894, xxi, 934.

Male, aged thirty-seven years. At operation there was found peritonitis and invagination of the bowel, the latter containing an introverted Meckel's diverticulum. A section of intestine was removed and death followed the same day.

Case 2.—1898. De Quervain, *Centralbl. f. Chirurgie*, 1898, xxv, 839.

Male, aged sixteen years. Patient was seized with severe abdominal pain and vomiting, without known cause. There were numerous borborygmi, but no passage of gas. No blood in stool. There was palpable resistance in the ileocecal region, but no tumor. Moderate distention and diffuse tenderness. Laparotomy revealed a gangrenous intussusception, which was removed entirely and an artificial anus produced. Death followed in a few hours. The part removed contained an invaginated Meckel's diverticulum 5 cm. long.

Case 3.—1898. v. Stubenrauch, *Centralbl. f. Chirurgie*, 1898, xxv, 137.

Female, aged five and a half years. Patient became acutely ill with severe colic and tenesmus, with bloody stools. On second day she had vomiting. On the fifth day she was admitted in a collapsed condition. The abdomen was moderately distended, sensitive to pressure, and especially prominent below the navel. At operation an intussusception of the ileum was found, 10 cm. from the ileocecal valve. Resection; death in two hours. The intussusception was gangrenous and contained an invaginated Meckel's diverticulum 5½ cm. long.

Case 4.—1898. Erdmann, *Ann. Surg.*, 1900, xxxi, 186; *New York Med. Jour.*, April 16, 1898.

Male, aged nine years. Illness began with colicky pains in right side of abdomen, then vomiting and bloody stool. The next day tenesmus, and on the second day severe shock and a palpable tumor extending from the right iliac fossa to the tenth costal cartilage. The abdomen was distended, tympanitic, and tender. At operation an intussusception was found with its apex within six inches of the ileocecal valve. It was irreducible, gangrenous, the intestines were deeply engorged, and there was a quantity of pus in the abdominal cavity. Resection, end-to-end anastomosis; death in four days. At the end of the invagination there was an introverted Meckel's diverticulum.

Case 5.—1898. Moroni, *Virchow's Hirsch Jahresbericht*, 1898, xxi, 289. Male, aged twenty-six years. Onset acute; pain and vomiting. Had previous operation for ileus due to axial torsion.

Renewed obstruction, death. Pathology, a complete ileal intussusception caused by inversion of Meckel's diverticulum, which contained a fibrous polyp the size of a cherry.

Case 6.—1899. Strauch, *Zeitschr. f. klin. Med.*, 1899, xxxviii, 465; *Hildebrandt's Jahresbericht*, 1899, v, 627.

Female, aged six years. Had been subject to severe attacks of colic for years. Suddenly had complete obstruction and was operated after thirty-six hours. There was an invagination of the intestine 15 cm. long, the apex of which consisted of a Meckel's diverticulum completely invaginated; resection; death.

Case 7.—1899. Robinson, *British Med. Jour.*, 1899, ii, 1416.

Male, aged five years. Patient had pains in belly, which became localized about the umbilicus during the night, and were accompanied by bilious vomiting. There were hiccough and thirst, but no distention. The next afternoon the pain became continuous, and distention appeared and became worse in the evening. There was a little blood in the enema fluid. There was no rigidity nor special tenderness. There was a lump over Poupart's ligament, which was comparatively dull on percussion, and on palpation by rectum there was a cylindrical mass three inches long in Douglas' pouch. Upon incision clear fluid escaped. The main invagination was easily reduced, but the introverted Meckel's diverticulum had to be excised. The patient collapsed and died in two hours after the operation.

Case 8.—1899. Brunner, *Beitr. z. klin. Chir.*, 1899, xxv, 344.

Male, aged four years. There had been no previous illness. The onset was sudden, with abdominal pain. In a few hours there was a bowel movement, followed by considerable hemorrhage, after which the pain became continuous, and the constipation absolute, notwithstanding frequent enemas. The abdomen was distended, but not rigid. There was dulness on percussion, from the right iliac fossa to the region above the pubes, and in the latter situation a hard nodular mass could be felt. Operation was performed three days after the beginning of the illness. An invagination of the ileum extending into the cecum was found, which, being irreducible, was resected. The operation lasted two and a half hours. The patient recovered. Within the invagination was an inverted Meckel's diverticulum, with a tumor at its apex. The tumor lay immediately beneath the serosa, unattached to the intestinal wall, and was formed of two parts, a superficial layer of fat and a deeper portion, which was glandular, resembling the pancreas.

Case 9.—1900. Bayer, *Centralbl. f. Chirurgie*, 1900, xxvii, 1138.

Male, aged two and a half years. Illness began with a bowel movement attended by severe pain, which was followed by obstruction. A tumor was palpable in the ileocecal region, and later in the region of the hepatic flexure. At operation the bowel was disinvaginated without difficulty. There became apparent a dimple, 15 cm. from the valve, which marked the base of a Meckel's diverticulum 3 cm. long, which was invaginated into the lumen of the gut. This was everted and its lumen obliterated by a series of puckering stitches; recovery.

Case 10.—1900. Hohlbeck, *Arch. f. klin. Chir.*, 1900, lxi, 1.

Male, aged eighteen years. Abdomen somewhat distended, but not tender. Vomiting of yellow fluid. The flanks were dull on percussion. No tumor was palpable until the patient was in narcosis, when a lump was found in the ileocecal region. At operation an ileocecal invagination was found and easily reduced. A Meckel's diverticulum was present, and had been drawn into the intussusception. The mucosa was separated from the muscle of the diverticulum and was invaginated, forming a floating tumor as large as a walnut in the lumen of the bowel. The diverticulum was excised. Death on the second day.

Case 11.—1901. Eve, *British Med. Jour.*, 1901, ii, 582.

Male, aged thirteen years. Illness began twenty-eight days before operation. Upon incision an intestinal invagination appeared and was resected. The patient died. At the apex of the intussusception was an invaginated Meckel's diverticulum.

Case 12.—1901. Pitts, *British Med. Jour.*, 1901, ii, 578.

Male, aged eighteen years. The patient, after eating a pint of cherries, had severe abdominal pain, which at first improved, but after five days became worse. The abdomen became distended, and there was some dulness and resistance in the cecal region. At operation an intussusception was found in the hepatic region. The gut was opened and emptied of a pint of fluid. A Meckel's diverticulum had invaginated into the intestine, and was reduced by finger through an incision. The diverticulum was two feet from the valve. Recovery.

Case 13.—1901. Morison, *Lancet*, 1901, ii, 1047.

Male, aged five years. The patient was seized with acute abdominal pains, coming on in paroxysms and with vomiting. Blood was passed by rectum. There was a sausage-shaped tumor in the left iliac region. At operation an intussusception of the lower ileum was found and reduced. It contained an inverted Meckel's diverticulum, which was removed. The child recovered.

Case 14.—1902. Travers, *Lancet*, 1902, ii, 146.

Male, aged ten years. The patient suffered repeated attacks of abdominal pain in the right side and vomiting. The abdomen was flat, except for a prominence about McBurney's point, where a tumor about 2 x 1 inch in size was palpated. It later disappeared, giving place to an indefinite mass. At operation the ileum was found invaginated three inches into the colon, and was reduced with some difficulty. At its upper end was a lump as large as a filbert, which proved to be an inverted diverticulum, three-quarters of an inch long. Recovery.

Case 15.—1902. Wainwright, *Ann. Surg.*, 1902, xxxv, 32.

Male, aged seventeen years. Illness began six days before admission, with loss of appetite, sense of fulness after eating, and constipation. Worked for five days. On the fifth day he was seized with severe epigastric pain and began to vomit. Enemas returned bloody. On admission to the hospital the abdomen was retracted and board-like, tender over lower part, but no tumor was palpable. Upon incision clear fluid gushed out and an intussusception three inches long was found three feet from the valve, which had at its apex an invaginated Meckel's diverticulum about an inch long. It was removed. Recovery.

Case 16.—1903. Terry, *Lancet*, 1903, i, 961.

Male, aged twelve years. The patient had first abdominal discomfort, soon followed by severe attacks of pain, which was most acute below and to the right of the umbilicus. Stools were loose, watery, and blood-stained. Distention was slight. A sausage-shaped tumor was palpable, running upward toward the liver. It became harder during the attacks of pain, and varied in size from time to time. At operation an invagination, twelve inches long was found, at the apex of which was an inverted Meckel's diverticulum six inches long. Recovery.

Case 17.—1903. Zum Busch, *Centralbl. f. Chirurgie*, 1903, xxx, 733.

Male, aged twenty-one years. Patient had dull pain in umbilical region for fourteen months. The present attack began suddenly, with severe pain, fluid stools, and tenesmus. Later there was almost constant vomiting and blood per anum. The right rectus muscle was tense, and a tumor the size of a child's head was palpable in the ileocecal region. At operation an ileocecal invagination was reduced with much difficulty. There remained a tumor in the ileum, wherefore a meter of intestine was resected, with lateral anastomosis. The tumor proved to be an invaginated Meckel's diverticulum, with a lipoma the size of a hazelnut at its apex. The patient recovered.

Case 18.—1903. Dobson, *Lancet*, 1903, i, 1161.

Male, aged four and a half years. Illness began with acute abdominal pain, vomiting, and discharge of blood and mucus from bowel. In thirty-six hours the vomiting had ceased, the pain became constant, with pulse 120 and temperature normal. There was a soft, tender, movable swelling in the right iliac region, extending upward to the right costal margin. At operation the same evening an ileocecal intususception was found, with a pedunculated swelling at the apex. Corresponding to this on the surface of the gut was a dimple into which a small mesentery passed. The swelling was an invaginated Meckel's diverticulum. Resection, Mayo Robson bobbin; recovery.

Case 19.—1904. Cawardine, *Lancet*, 1904, i, 505.

Child, aged fourteen months. At operation two days after beginning of symptoms an intussusception was found which had just entered the colon. One invagination was reduced and was found to contain a second invagination, within which was an introverted Meckel's diverticulum. The diverticulum was fifteen inches from the valve. The patient died in collapse.

Case 20.—1904. W. Watson Cheyne, *Ann. Surg.*, 1904, xl, 796.

Male, aged nineteen years. The patient had indefinite abdominal pain for two years. Several of the later attacks were attended with vomiting and diarrhea. The vomitus was greenish or yellow. On admission the abdomen was slightly distended. A week later a distended loop of bowel appeared in the left iliac region, which later appeared as a definite tumor. In the evening the bowels moved and contained no blood. At operation, three days later, an intussusception was found in the pelvis. It was eighteen inches long and was easily reduced. A second invagination presented itself and was easily squeezed out. It proved to be an inverted Meckel's diverticulum. This was resected and a lateral anastomosis done. The gut at the site of the diverticulum contained a longitudinal constriction. The patient recovered.

Case 21.—1907. Coffey, *Ann. Surg.*, 1907, xlv, 42.

Male, aged seven years. There was a history of repeated attacks of cramps beginning at two years, recurring every month, and sometimes more often. The cramps were always accompanied by bloody stools. The present attack began with severe pain and frequent vomiting during the first day. The condition improved, but abdominal tenderness continued. The patient was up a portion of the second day and remained well until the fifth day, when severe symptoms returned. On the sixth day the child entered the hospital. There was no distention. On the right side a mass was palpable, extending under the ribs. At operation reduction proved impossible, and the invagination was resected. There was an inverted Meckel's diverticulum at the apex of the intussusception. The patient recovered.

Case 22.—1907. Jäckh, *Deutsch. Zeitschr. f. Chir.*, 1907, lxxxvii, 192.

Female, aged thirty years. The patient had been ill for six months, with cramping pains almost daily. They had become worse in the last three weeks, and were occasionally accompanied by vomiting. There was moderate distention and visible peristalsis in the middle of the abdomen. There was no dulness nor tenderness. The day following the examination there was a bowel movement. Seven days later tumor was felt at the left of the uterus. At operation an invagination was recognized and was easily reduced, but a nodule as large as an egg remained about one meter above the valve. This portion of the gut was resected. The nodule proved to be an invaginated diverticulum, which was necrotic at the extremity. The lumen of the diverticulum had become closed, and the gut proximal to the diverticulum was double the thickness of the distal part. The patient recovered.

Case 23.—1907. Bidwell, *Lancet,* 1907, ii, 682.

Male, aged three and a half years. The patient was born with an umbilical hernia, which was repaired at the age of one year. Severe hemorrhage from the bowel four months before present attack. There had been repeated attacks of pain, which came on at intervals of one week. They began in the morning and passed off after two hours. Final attack began as the others, but failed to pass off. Vomiting appeared and a tumor was palpable in the right lumbar and hypochondriac region. At operation an intussusception was found involving the large intestine to the middle of the transeverse colon; it was black and edematous, but was viable and was reduced. Four weeks later it was necessary to repeat the laparotomy. An irreducible invagination of the small intestine was found and resected. The specimen contained an inverted Meckel's diverticulum. Recovery.

Case 24.—1907. von Mandach, *Lancet,* 1907, ii, 1733.

Male, aged two and a half years. No history of previous trouble. The child fell ill with slight dyspeptic symptoms. On the seventh day the bowels became completely obstructed, meteorism developed, and operation was performed. There was a double ileocecal invagination, with an introverted Meckel's diverticulum at the apex. The invagination was reduced, the diverticulum everted, and its lumen closed by purse-string ligatures. Recovery.

Case 25.—1907. Kopyloff, *Mediz. Obosrenje,* Band lxviii, abstracted in *Hildebrandt's Jahresbericht,* 1907, xiii, 765.

An obstruction of the bowel originating from an inverted Meckel's diverticulum. A portion of intestine 60 cm. long was resected. Patient recovered.

Case 26.—1908. Brin, *Bull. et mém. Soc. de chir.,* 1908, xxxiv, 1267.

Female, aged thirty-nine years. The patient had been having attacks two or three times yearly for twelve years. During the past year there had been tenderness between attacks. A pelvic tumor was palpable and was thought to be an inflamed salpinx. Supravaginal hysterectomy was performed. Eight days later she had an attack of acute obstruction. The intussusception was reduced, and an inverted Meckel's diverticulum was evaginated and resected. The patient recovered.

Case 27.—1908. Gray, *Ann. Surg.,* 1908, xlviii, 801.

Male, aged eight years. At five years there was an attack of abdominal pain, with passage of blood by rectum. The present illness began with pain in the region of the umbilicus. There was temporary improvement, but after two days, following a bowel movement produced by licorice powder, violent pain returned. On the fifth day there was increased pain and absolute constipation, followed the next day by vomiting. No blood was passed by rectum. The abdomen was distended, especially above the navel, which was raised, and at the apex of a dome. There was no rigidity nor tenderness. Under anesthesia a tumor was palpable under the liver. At operation a good deal of straw-colored fluid was found in the abdomen. There was an ileocecal invagination, which was removed from the cecum. The enteric part was irreducible and was resected. The patient died fifteen hours afterward. The resected portion contained an inverted Meckel's diverticulum, at the base of which the intestine was considerably narrowed.

Case 28.—1908. Kothe, *Deutsch. Zeitschr. f. Chir.*, 1908, xcv, 286.

Male, aged twenty-three years. The patient had an attack six months previously. The final attack began suddenly, with pain, vomiting, and chill. Vomiting did not recur. The pain was most severe between the umbilicus and symphysis. There was passage of neither feces nor flatus. When admitted to the hospital on the fourth day the abdomen was not distended, but was slightly tender. The next day tympany became marked, vomiting was violent, and the general condition was much worse. At operation a moderate amount of serosanguinolent fluid escaped from the abdomen. An intussusception was found in the ileocecal region, and as it was irreducible it was resected. The intestinal contents were allowed to flow out of the free end of the gut, and then an end-to-end anastomosis was done. The patient recovered. At the tip of the invaginated diverticulum was an infarcted polyp 6 cm. long.

Case 29.—1908. Kothe, *loc. cit.*

Male, aged seven months. Illness began three days before operation. Vomiting occurred once on the second day. Enemas were used without result; in one the water was returned bloody. There was no tympany, but the abdomen was generally tender, particularly so in the ileocecal region. There was no dulness nor tumor. Under anesthesia a tumor was palpable in the right lower quadrant. At operation a moderate amount of serous exudate escaped. The ileocecal tumor was recognized as an intussusception, which was pushed into the ileum, but the gut ruptured from the manipulation, and was therefore resected. The cut ends were sewed into the abdominal incision. The patient died from exhaustion. There was no peritonitis. Examination of the specimen showed a diverticulum 2 cm. long, which was inverted into the ileum.

Case 30.—1908. Delore et Leriche, *Revue de Chir.*, 1908, xxxviii, 39.

Male, aged six years. Patient had had several attacks of obstruction in last year. July 22, 1907, had vomiting of bile, colicky pains, no passage of gas, or feces. Next day pulse was 80, temperature was 38.5° C. and there was a tumor in the right iliac region. July 25, pulse, 115; temperature, 37.8°; violent colicky pains, bilious vomiting, complete obstruction; no melena. The abdomen was distended and there was a mobile tumor in the left iliac region. At operation (third day after beginning) there was a large quantity of liquid in abdomen. The invagination could not be reduced, was resected, and the intestine joined end-to-end with a Murphy-Villard button. Patient died forty-eight hours later. The piece resected was 40 cm. long, and the intussusceptum was 15 cm. long. The mucosa was gangrenous. There was a depression in the serous surface into which a probe could be thrust 5 or 6 cm.—an inverted Meckel's diverticulum.

Case 31.—1909.—Busch, *Deutsch. med. Woch.*, 1909, xxxv, 1369 and 1370.

Child, aged seven years. The patient came to clinic on the third day of the illness. At operation an invagination was found which reached from 50 to 60 cm. above the ileocecal valve to the hepatic flexure. At the end of the intussusception was an inverted Meckel's diverticulum with a hard nodule as large as a hazel-nut at the apex which proved to be an accessory pancreas. The diverticulum was resected and the patient recovered.

Case 32.—1909.—Riedel, *Deutsch. med. Woch.*, 1909, xxxv, 1655.

Female, aged twenty-five years. The attack began suddenly with severe pain in abdomen and vomiting. There was tenderness at first below the flanks. The diagnosis was perforative peritonitis, with intestinal paralysis. At operation an invagination 20 cm. long was found in the pelvis and was resected. The patient died at the end of the operation from heart failure. The diverticulum was found inverted and partly gangrenous.

Case 33.—1911. Mühsam, *Berl. klin. Woch.*, 1911, xlviii, 1089.

Female, aged five years. The patient had had two attacks of obstruction, which were cured by enemas. The present attack began with vomiting and obstruction. There was a hard, sausage-shaped movable tumor to the right of the navel. There were 30,000 leukocytes. At operation there was an invagination reaching to the hepatic flexure, which was reduced with some difficulty. 20 cm. from the valve was a diverticulum the size of a little finger, invaginated into the bowel. It was everted and resected. The patient recovered.

Case 34.—1912. Drummond, *Ann. Surg.*, 1912, lv, 404.

Male, aged twenty-nine years. Admitted July, 1909 for hemoptysis. He was discharged but soon returned complaining of colicky pains in abdomen, epigastrium, and left hypochondrium. He had occasional griping pains until November, 1910. In December of same year had renewed abdominal pain with tenderness and distention in the epigastrium. In the following February, after sudden pain in the abdomen with vomiting, a mass appeared in the lower abdomen which increased in size and became harder during the paroxysms of pain. He passed a pint of blood per rectum. Operation February 6, 1910. There was some free fluid in the abdomen and an intussusception four inches from the ileocecal valve. It was easily reduced but a lump remained within, and a portion of intestine was therefore resected, with end-to-end anastomosis. Death February 14, from peritonitis from leak in suture line. Specimen showed a diverticulum three and one-half inches long with a constriction of the gut at the point of its attachment.

Case 35.—*Loc. cit.*

Female, aged three years. The child had an attack every six weeks, for the last nine months, which were relieved by enemas and castor oil. Duration of the present attack, one week. Two hours after breakfast the patient was seized with sudden severe pain about the umbilicus followed by vomiting. No flatus nor feces was passed for two days. On admission pulse was 126; temperature, 99.8°; upper abdomen was distended and peristaltic waves were visible in the region of the umbilicus on right side. There was no rigidity nor tumor. At operation, an intussusception was found and easily reduced except where the diverticulum was inverted into the gut. Diverticulum was reduced and excised. Child died twelve hours later. Diverticulum was one and one-fourth inches long and contained an accessory pancreas.

Case 36.—*Loc. cit.*

Male, aged fifteen years. Four days before admission the patient had an attack of pain in lower abdomen, with nausea and vomiting. Next day bowels moved and he was better. In the evening severe pain and vomiting returned with relief next morning. On the second day following when admitted, he had slight pain and distention, no tumor nor dullness. There was tenderness in left side. At operation an irreducible intussusception of the small bowel was found and resected, with end-to-end anastomosis. Death shortly afterward. At apex of intussusception was a Meckel's diverticulum four and one-half inches long, completely gangrenous.

Case 37.—*Loc. cit.*

Male, aged eleven years. Three days before admission he complained of sudden pain in epigastrium followed by vomiting. No movement of the bowels occurred for two days. Abdomen was distended, tympanitic, and tender. A tumor was palpable by rectal examination. At operation, free fluid was found in abdomen, and an intussusception of small intestine in pelvis. Resection was followed by death. A Meckel's diverticulum one and one-half inches long was found completely inverted and gangrenous.

Case 38.—*Loc. cit.*

Male, aged twenty-five years. The patient had attacks of abdominal pain a few months previously which were relieved when bowels moved. Three days before admission he had a severe attack of pain after drinking water. His bowels moved freely and he vomited. Bowels had not moved since first day of illness. Abdomen was retracted and rigid, with tenderness in the epigastrium. At operation an intussusception appeared which was nearly gangrenous. It was resected, and ileum was joined to cecum by means of a Murphy button. Patient recovered. At the apex of the intussusception was an inverted Meckel's diverticulum four inches long, gangrenous at the tip.

Case 39.—1913. Drummond, *Surg., Gynec., and Obst.*, 1913, p. 656.

Male, aged thirty-four years. In August, 1911, began to have attacks of abdominal pain with rumbling and sometimes diarrhea. In November, attacks became more pronounced. A week before admission the vomit contained blood. For three days before admission he vomited incessantly and complained of pain coming on in spasms. When examined, pulse was 128; temperature, 98°; abdomen was distended, no intestinal movements visible. Rectal examination was negative. Enterotomy was done and death followed in two days from toxemia. Postmortem examination showed an intussusception with a Meckel's diverticulum three inches long at the apex.

Case 40.—*Loc. cit.*

Male, aged eight years. No record of previous attacks is given. The present attack lasted a week, the intussusception was resected and the patient died. A small Meckel's diverticulum, two inches in length was found inverted into the gut.

Case 41.—1913. Turner, *Guy's Hosp. Rep.*, ix, reported by Wellington, *Surg., Gynec. and Obst.*, 1913, xvi, 74.

Male child, aged sixteen months, operated upon by Lane. There was an intussusception in right iliac region, which was reduced and a second found. This was reduced and a third found. The last contained an inverted diverticulum.

The following cases of intestinal intussusception with an invaginated Meckel's diverticulum are recorded, but insufficient details are given.

Treves, Intestinal Obstruction. Philadelphia, 1884, p. 215. Specimen in Guy's Hospital Museum, No. 1819 (45).

Treves, Intestinal Obstruction, second edition (quoted by Dobson, *Lancet*, 1903, i, 1161). Specimen in Museum of Royal College of Surgeons of England, No. 2718 a.

Adams, *St. Bartholomew's Hospital Reports*, 1891, xxvii, 171. Obscure symptoms of intestinal strangulation had existed about a fortnight. At autopsy an intussusception into the cecum was found. It contained an inverted diverticulum. Subject was a male.

Willett, *St. Bartholomew's Hospital Reports,* 1891, xxvii, 171. Specimen No. 2183 in the museum of St. Bartholomew's Hospital. Double intussesception of intestine and Meckel's diverticulum in a male.

The following cases are reported as examples of this condition, but are doubtful

O'Conner, *British Med. Jour.*, 1894, ii, 123.

Male, aged thirteen years. Eight days after a severe wetting had two or three rigors, with a temperature of 104°. He was better the next four days, but had no bowel movements, notwithstanding the use of laxative. The next day after the use of opium he passed a portion of the ileum eleven and and one-quarter inches long with a Meckel's diverticulum. "The upper portion was invaginated into the lower, the entire length of the diverticulum appearing through the lower orifice."

Boldt, *New York Med. Record,* 1900, lvii, 655. No details given.

Guyot, reported by Forgue et Riche, "Le Diverticule de Meckel," Paris, 1907, p. 89.

Male, aged ten years. Final attack lasted five days. An entero-anastomosis without resection was done. Death. Autopsy showed an ileocecal intussusception with a Meckel's diverticulum.

Brook, *British Med. Jour.*, 1907, ii, 862.

Taeck, referred to by Von Mondach, *Lancet,* 1907, ii, 1733.

Ryan, *Intercolonial Med. Jour.*, Australia, 1907, xii, 459. Male, aged nine years. Onset of illness acute with pain and vomiting. At operation twelve inches of gut near iliac region were resected. The patient died. The intussusception started from a polyp at the apex.

In summarizing the data of these cases one recognizes regrettable paucity of details, especially as to pathology. A comparative study of the physical condition of the gut, as observed at operation in connection with the subsequent history of the various cases, would be of great value in guiding the surgeon toward the best operative procedure.

Points worthy of special notice are age, sex, manner of onset, appearance of tumor, and the relatively slow course.

Age. The age varied from seven months (29) to 39 years (26), the average in the 41 cases quoted being thirteen years. Of these 20, or 49 per cent., were under ten years of age, 10 between ten and twenty years.

Sex. Of those in which the sex is given 31 were males and 7 females, giving a ratio of over 4 males to 1 female.

Previous Attacks. In 17 of the cases a history of previous attacks is given. In none of the other cases is it specifically stated that there were no previous attacks. In those cases in which previous attacks have been recorded it stands out so plainly that one is disposed to suspect that some of the reporters may have overlooked the importance of a history of previous trouble in the making of a diagnosis. For this reason it seems worth while to examine these histories with some care. The factors worthy of attention are the number of previous attacks, the location of the pain, the presence of a tumor, and the presence of blood passed per anum. In 3 of the recorded cases (5, 27, and 28), a single attack is mentioned, and this was the case in our patient. In 1 (33) two attacks are mentioned. In 9 (6, 14, 23, 26, 30, 34, 35, 38, and 39) many or repeated attacks are mentioned. In 1 case (21) monthly attacks since the age of two years are mentioned, and in 1 (22) the pain is mentioned as having been present continuously for six months. The character of the pain has been described as dull in 1 case (17), colicky or cramps in 6, 21, 22, and in our own case. In 1 case (14) the pain is recorded as having been in the right side, in 2 (16 and 34) about the navel, and in our case just below the navel. In 1 case (14), in which obstruction was diagnosticated a a tumor was felt and in our case a tumor was diagnosticated during the existence of the obstruction. Blood was discovered in the stool but twice (21 and 27). It is interesting to note that the ages of these two patients were respectively seven and eight years, a later age than the usual occurrence of simple intussusception.

The Final Attack. The history of the final attack which brought the patient to operation or autopsy (or both) presents much that is interesting. In this, too, as in the history of preceding attacks there is a want of negative history, so that it is impossible to determine if certain cardinal symptoms were absent or whether the historian was ignorant of their interest or importance and failed to make record of their presence.

It is a matter of judgment as to what factors shall be considered of fundamental importance. The nature of the disease indicates what factors are likely to be most prominent and likewise what secondary features are likely to appear. Thus pain may be regarded as the cardinal feature; accompanying this are vomiting and distention as positive results of the obstruction and absence of stool and flatus as negative results. Tenderness and rigidity of the abdominal walls and the presence of free fluid in the abdominal cavity give evidence as to the degree to which the intestine has suffered from its acute malnutrition. Conversely, blood in the stool gives similar evidence of the state of nutrition of the mucous membrane. With this general scheme in mind we may proceed to investigate our evidence.

Pain. We may assume that pain is present in every case and our interest lies in its character and location. It is usually colicky in character, and is located usually about or below the umbilicus or in the right side. The pain bears evidence of the preponderance of traction in the production of symptoms in the condition in question as compared to some other type of obstruction. It is intense, cramp-like, and is disposed to intermission. Usually there are periods of nearly or quite complete freedom from pain. It is not attended by evidence of inflammation and collapse.

Vomiting. In 24 cases this symptom was reported present. In 1 case (18) it is stated to have been present the first thirty-six hours, and in 1 (21) for the first day and in 1 (32) at the beginning. In 1 (27) it is not noted until the eighth day. The character of the vomitus is usually dark green or yellowish. In 1 case (39), the vomit a week before admission contained altered blood. Vomiting, compared to many types of intestinal obstruction, is characterized by its moderate intensity.

Meteorism. The relation of this symptom of vomiting is indicated by the fact that in all but 5 of the 23 cases in which there was vomiting, meteorism likewise is recorded. In 2 of the 3 exceptions meteorism is stated to have been absent, and in the others it is not mentioned. The records on this point are rather striking, inasmuch as in this disease meteorism never appears to be pronounced. Possibly this is because at the time of obstruction distention of the gut seldom reaches a degree comparable to instances in which paralysis is a factor.

Tenderness. This symptom is usually associated with the previously mentioned phenomena of vomiting and distention. It is less often present, however, for in 3 cases it is stated to have been absent, while both tenderness and meteorism were present. In our case tenderness was present but not marked. It is nearly always a late symptom.

Rigidity. In 1 case (15) only is rigidity stated as being board-like, and in 1 (17) the right rectus was stated to have been rigid. In Case 38 the abdomen was rigid and retracted. In our case the right rectus was more rigid than the left, but yet lacked the rigidity of a response to an inflammatory process. On the whole it is a negative sign.

Abdominal Exudation. The presence of a free exudate was noted in 10 and 32 and was well marked in our case. In a number of other cases it is stated that a quantity of fluid escaped when the abdomen was opened, though no note was made of it previously. In these it is more than likely careful examination would have shown free fluid in the flanks. Its value as a sign consists in that if its presence is detected it may mislead the observer to believe that an inflammatory exudate is present.

Blood in the Stool. In 12 it is specifically stated that blood was present in the stool, but in each instance the amount was but slight, except in Case 34 in which a pint of bright blood was passed. In 4 (2, 23, 27, 30,) it is also specifically stated that there was no blood. The same is true in our case. When blood is present tenesmus is not marked.

Tumor. The most typical factor in the picture of the disease is the presence of tumor. Tumor is stated to have been present in 20 of the recorded cases. In our case the attending physician was able to palpate tumor on the third day, but when the patient came into our hands none could be felt because of the distention. Dulness and resistance were noted in the right flanks of two additional cases (2 and 12). In 2 cases it is specifically stated that no tumor could be felt (2 and 15). In 2 cases (10 and 29) tumor was felt under narcosis. The location of the tumor is interesting. The most frequent location is in the ileocecal region, where 7 were found and next in frequency were 2 in the hepatic region, while 4 were in both these regions, beginning in the ileocecal region and extending to the hepatic region. In 2 cases (3 and 34) the tumor was located below the navel, once (7) in Douglas' pouch, once (22) to the left of the uterus, once (37) felt per rectum, and in our case to the right of the umbilicus. The tumor is sometimes described as sausage-shaped, sometimes movable, and sometimes variable in size and consistency.

Duration of the Disease. The time the disease had existed from the beginning of the illness until it came under observation varied from twenty-four hours (8) to twenty-eight days (10). One was thirty-six hours (6), 2 were forty-eight hours (19 and 34), 7 (13, 28, 29, 30, 31, 37, 38) were three days, 1 (36) was four days, 1 (3) was five days, 2 (15 and 21) six days, 5 (24, 27, 35, 39, 40) seven days, 1 (23) eight days, and our case was five days. This bears evidence that the malady is but moderately acute and accounts for the modified form in which some of the cardinal symptoms of obstruction appear—notably, vomiting and meteorism.

Diagnosis. From the foregoing it is evident that the material out of which to construct a diagnosis has varied in the different cases. It is worth while to summarize this material and to compare it with groups of analogous symptoms produced by other diseases. Pain is the prominent symptom, is usually the earliest to appear, and is the most persistent. The characteristic feature is its cramp-like intermittent character. Its location is usually in the middle of the abdomen, sometimes more to the right side. To pain the evidence of obstruction is soon added, usually vomiting first. This may be early, when it is a reflex from the cramp-like pain or later, when it is the result of the accumulating intestinal contents. In the former case the vomitus may consist of food or greenish mucus, and in the latter of large quantities of yellowish or brownish fluid. With these indications of abdominal storm the lack of abdominal tenderness and muscle rigidity, coupled with a normal or subnormal temperature, marks the condition as some disturbance of the fecal current. The presence of repeated disturbances leading up to the attack with the above symptoms should give some hint as to the nature of the malady. Our own case had all the ear-marks of the disease and should have been diagnosticated if we had but had the opportunity to study the recorded literature before proceeding to operation.

Differential Diagnosis. This disease may be mistaken for obstruction due to other mechanical causes or to abdominal disasters, mostly inflammatory, which interfere with the dynamics of the intestinal tract in an indirect way.

The causes for obstruction which might come into question are the various internal hernias and strangulations, notably those dependent upon a looping of the gut about a band. These bands may be inflammatory in origin or may be due to congenital anomalies, such as a Meckel's diverticulum attached at both ends. Some of the internal fossæ may ensnare a loop and give rise to similar symptoms. Furthermore, these conditions may give a history of repeated attacks almost like those of intussusception. The presence of a tumor, however, will exclude the probability of band obstruction and to a less degree that of fossa obstruction. Intussusception without diverticulum usually occurs in the first year and a half of life, so that in these cases one can assume the presence of a Meckel's diverticulum only when there is a hard nodule at the head of the intussusception or some deformity at the umbilicus. It is presumed that any surgeon sufficiently advanced in his profession to have any acquaintance with the literature of intestinal obstruction would not fail to exclude hernia of the external openings.

The inflammatory lesions of the abdomen usually present symptoms plainly divergent from those of the affection under discussion, yet because of their frequency they are likely always to be present in the surgeon's mind. Perforative lesions are regularly attended by sudden pain, but it is not cramp-like and remissions are not apt to intervene. The practitioner, to be sure, may cause perforation to simulate intussusception by giving morphin, and may thus confuse the surgeon. Tenderness and rigidity also in this way may be suppressed, but it is not usual for an abdomen which is the site of an inflammation severe enough to demand large doses of morphin to quiet down under its influence sufficiently to obliterate all evidence of tenderness and resistance. The general appearance of the patient may give evidence of a severe inflammatory lesion in the belly, and even if the distinctive symptoms are neutralized by morphin, an expert clinican should be able to read the patient's true condition in his face. As in all cases of obstruction the absence of reactive manifestations is a most important differential point. The absence of accelerated pulse rate and the normal or subnormal temperature are very suggestive. In this respect, however, fallacies beset the diagnosis from two directions. Other abdominal lesions such as perforative appendicitis may show little or no reaction, and in the late stage of the disease under discussion the pulse may be rapid and the temperature may rise.

The diagnosis in complicated cases is thus not to be made upon general evidence, but upon the consideration of the special features of individual cases. If the disease has been determined to be surgical it is important to decide between an obstruction and an inflammatory lesion, for upon this decision depends the position of the incision. That this is not always easy is shown by the late hour at which so many cases reach a final solution, often indeed at autopsy. Lesions not surgical in character, which are capable of giving a like series of symptoms, are numerous. The early age of most of these patients excludes the two diseases, aside from frank inflammatory conditions, which most resemble obstruction—namely, gall-stones and pancreatic disease. The ephemeral nature of the acute intestinal colics should differentiate them at an earlier date than has been done in most of the reported cases. The fact that some of the cases of the disease under discussion had been preceded by a series of slighter attacks naturally leads to delay in the hopeof the same favorable outcome. That blood in the stool should be ascribed to dysenteric diseases is excusable, since in this affection the pains are often diffuse over the abdomen. In dysentery the passage of mucus and stool is accompanied by tenesmus, but in intussusception blood passes without tenesmus unless the inverted gut approaches the anus in which event it may be reached by the palpating finger. After tumors appear or meteorism gradually ensues delay should not be countenanced.

Pathogenesis. The factors responsible for the invagination of Meckel's diverticulum have been the subject of much speculation. The one essential is that the distal extremity of the diverticulum be unattached. It has long been known that the floating diverticulum is subject to a varity of accidents, of which torsion has been the most common. The blood supply being derived from the small intestine usually opposite its own source of supply makes the nutrition of the diverticulum at all times somewhat precarious. That gangrene about the base should occur need therefore occasion no surprise.[1] To what degree such accidents may be responsible for the various narrowings and thickenings at the attachment of the diverticulum and of the intestine itself is open to question. Gray (24) believes that such accidents are responsible for their existence. Careful histologic study which might throw some light on the subject is lacking. That some of these anomalies are congenital is quite likely. Even though it is granted that they are the result of pathologic processes, the mechanics of inversion is not explained. Küttner[2] was of the opinion that in his case of inversion of the diverticulum an accessory pancreas at the tip of the diverticulum was responsible. He thinks that a polypus or a fecal mass might act in the same way. Accessory pancreases were present in Brunner's (8) case and in one of Drummond's (35), and a small lipoma was present in Zum Busch's. In Moroni's case (5) the diverticulum contained a fibrous polyp. Gray believes the presence of such a tumor would prevent rather than assist in the production of inversion. De Quervain (2) believed the rush of fluid along the intestine produced a negative pressure sufficient to produce an invagination. Gray (27) believes invagination begins at the base of the diverticulum, congestion at this point as the result of torsion causing swelling and mucus production being, according to him, the fundamental factor. That the mucosa is loosely attached is proved by Hohlbeck's (10) case in which the mucosa alone was invaginated. A narrowed base would permit an accumulation of contents, which when forced by active peristalsis into the lumen of the gut, might easily be accompanied by mucosa and this would ultimately drag the musculature after it. Intussusception might then follow immediately or sometime later.

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[1] Gray, British Med. Jour., 1907, ii, 825.

[2] Beitr. z. klin. Chir., 1898, xxi, 289.

The study of our case and of the literature would lead us to believe that intussusception of the gut at the point of attachment of the diverticulum is the first event and that inversion of the diverticulum occurs as a secondary process. A thickening of the gut wall at the site of attachment of the diverticulum might readily give the stimulus to such a course of events. That such an event is mechanically possible is illustrated by a case recently reported by Kasemeyer,[3] in which a carcinoma of the cecum became the apex of an intussusception. Other like instances have been reported. When a foreign body is to be propelled along the intestine this is accomplished by a relaxation of the wall in front of the object and a contraction behind it. If the thickening in the intestinal wall project within the lumen the physical characteristics of a foreign body within the intestine are produced. Such a thickening may occur within the diverticulum leading to a primary inversion of the diverticulum or it may occur about the base of the diverticulum in the wall of the intestine proper leading to an intussusception without an inversion of the diverticulum. It is only by such a mechanism that an inversion without intussusception or an intussusception without inversion can be explained. There must be a course common to them both. That such changes do occur is demonstrated by our case. Partial inversions or beginning intussusception would explain the repeated slighter attacks.

Treatment. Obviously treatment must be surgical. Enemas can hardly find a justification at the present time. The ideal procedure is reduction of the intussusception and eversion of the invaginated diverticulum, to be followed by the resection of the diverticulum. In order that this may be carried out the gut in all its portions must retain its integrity so as to permit the necessary manipulation, and the circulation must be in such a state as to maintain the nutrition of the gut after the treatment is completed. The invagination may be irreducible or the gut when relieved of its intussusception may not be viable. These possibilities must be judged at the time of the operation, for the state of the gut is dependent upon the duration and the degree of constriction to which it has been subjected. The former factor only is known in a given case. The treatment is divisible, therefore, under the following heads. (1) "When the gut is reducible and viable," and (2) "when irreducible or reducible and not viable."

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[3] Deutsch. Zeitschr. f. Chir., 1912, cxviii, 205.

When Reduction is Possible. In these instances the reduction of the intussuscepted gut is attempted by gentle pressure from above with the guarded assistance of traction from below. In some instances it has been easily accomplished, as in Cases 7, 8, 9, 10, 17, 19, 20, 22, 24, 26, 29, 31, 34, 35, and 41; while in Case 14 some difficulty was experienced. This may be said of our case. In Case 33 reduction was accomplished with difficulty. The diverticulum was reduced in Cases 19, 20, 24, 26, 38, and our own case. In none in which the intussusception was easily reduced was resection necessary except in Case 17, which was reduced easily and then resected, and in Case 29, in which the bowel was torn by the manipulation. It would seem therefore that if the gut is easily reducible it will be in such a condition that resection will not be required. In 1 case, however, (33) reduction was possible, yet gangrene occurred, requiring a secondary resection.

When the gut is reducible the problem of viability must be decided. The problem here is no different from that in any other case of intestinal obstruction. If the gut is in active peristalsis, after being re-released, it is viable. Slight peristalsis, according to Gaardlund[4] may occur in a gut which subsequently becomes gangrenous. Mesenteric thrombosis and great edema of the gut wall indicate impending gangrene. A deep lusterless black indicates necrosis. Less degrees of discoloration are compatible with restitution and one or more of the usual means for determining the point may be employed. These are chiefly the temporary use of warm compresses, the temporary exclusion of the suspicious loop without the abdominal cavity, and provision for drainage about the replaced loop, with the hope that should integrity fail external drainage will rescue the patient.

Gaardlund,[5] in a very carefully studied case, has called attention to the fact that the mucosa may be injured beyond repair when the musculature is still apparently viable. This is capable of producing delayed disaster. Reports of fatal cases are not full enough to permit a judgment as to whether or not a too conservative procedure has been responsible for deaths. Information as to the state of the mucosa in fatal cases in all types of obstruction is much desired.

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[4] Arch. f. klin. Chir., 1912, xcviii, 433.

[5] Loc. cit.

When the Gut is Irreducible. Resection obviously must be practised if reduction is not possible or if injury is inflicted upon the gut in the process of reduction. Thus in Cases 1, 2, 3, 4, 6, 11, 13, 15, 17, 18, 21, 23, 25, 29, 30, 32, 36, 37, 38, and 40 resection was done. When the gut is irreducible or if reducible, obviously unviable from gangrene or thrombosis already present or inevitable from injury to the mesentery or the gut wall inflicted during the effort at manipulation, a solution of continuity of the intestinal circulation is unavoidable. Three plans are open to the operator. (1) An artificial anus may be made prŏximal to the point of obstruction, allowing for the removal of the irreducible mass and the reëstablishment of the intestinal canal at a future date, or (2) the mass may be resected and the free ends of the gut brought externally, either with or without the employment of Paul's tubes, leaving the establishment of the gut continuity to a subsequent date, or (3) the mass may be resected at once and an anastomosis made.

In solving problems of treatment one must be guided by the experience of one's self and of others in the same class of cases and in allied cases which present analogous features. The personal equation of the operator here will have free play.

Reasoning from analogy it would seem that if the novice should meet such a problem an artificial opening would afford the patient the best chance of life. The same is true in the hands of the more expert when working under exceptionally unfavorable conditions. In other conditions resection of the offending mass should be done. Immediate anastomosis may or may not be done depending on the condition of the patient's intestinal tract. If the patient is still possessed of good power of peristalsis a skilful operator may proceed at once to anastomosis. If the gut has little or no visible power of propelling its contents, anastomosis would better be deferred. Unquestionably the stagnating intestinal contents will flow out of a Paul's tube with greater facility than through a new anastomosis opening and will be much sooner beyond the reach of avenues of absorption. Greater moral courage is required to quit than to go on.

If we try to substantiate these views from the recorded histories we are met by the fact that operators, except in a few cases, have chosen to do an immediate anastomosis, a fact which one could divine from reading the outcome of these cases.

Of the resected cases in which definite information is available 13 died and 9 recovered, which represents a high mortality; 5 of these cases came to operation in six to eight days, indicating a subacute process and one on the second (17), 5 on the third (13, 28, 30, 37, and 38) day and one (36) on the fourth day. One in which drainage was done (12) recovered and 1 (39) died. Of those in which reduction was possible, necessitating the removal of the diverticulum only, 9 recovered and 4 died. The better operative prognosis in the cases in which injury to the gut is slight is obvious.

The cause of death in those where reduction was possible and resection was not done remains to be determined. In Gaardlund's case reduction was possible, but secondary gangrene took place and he saved the patient by a secondary operation.

For the reduction of the mortality one must apparently look in the direction of a closer study of the advisability of resection when the gut is reducible or the question of drainage and temporary resection where the gut is certainly lost. More radical procedure in some of the simpler cases and more conserative procedure in the very grave cases seem to be the lines along which we may hope to advance to a better prognosis.

SPINAL GLIOSIS OCCURRING IN THREE MEMBERS OF THE SAME FAMILY, SUGGESTING A FAMILIAL TYPE.[1]

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The following cases present not only an unusual symptom group, but are chiefly of interest owing to the development of the condition in three members of one family, two brothers and a sister. One of the cases, C. S., a boy, aged thirteen years, came under my observation in May, 1912, following his admission to the neurological service at the Jefferson Hospital. The other cases, P. S., female, aged twenty-four years and E. S., male, aged twenty-two years, were studied in November of the same year. As the symptoms were practically identical in all three patients, one, the eldest, will be recorded in detail as illustrating the condition:

P. S., female, aged twenty-four years, single. She had the usual diseases of infancy and childhood and an attack of influenza when sixteen. Her menses began at the age of sixteen years and were regular and not especially painful. When she was aged about eight years a small sore appeared on the second toe of her right foot; her mother, thinking the sore contained a splinter, opened it and removed a small spicule of bone, the wound subsequently healing rapidly. Two years later a similar condition developed on the

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[1] The cases were presented before the Philadelphia Neurological Society, November 22, 1912.